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ABSTRACT

A study was conducted to: (1) provide normative data for the Brozovich-Hall Watson (BHW) scale, a non-verbal method of assessing cognitive style; (2) provide data for itwm revision and further refinement of the BHW; and (3) assess the effects of grade level (age), sex and socioeconomic status on cognitive style. The BHW was administered to 621 children ranging in grade level from preschoolers less than 4 1/2 years old to third graders. Socioeconomic level and sex were balanced at each grade level. Grade level proved the most consistent and powerful factor related to cognitive style. Results were generally consistent with previous research, indicating, for example, a decrease in use of color as a grouping category with increased grade level. Sex and socioeconomic level interacted significantly with grade level in their effects related to cognitive style, but neither produced consistent effects on cognitive style independent of grade level. Item analysis indicated a need to revise approximately 25% of the items. The BHW appears capable of assessing aspects of cognitive style among non-verbal populations. Plans and recommendations include: (1) revision of the BHW; (2) assessment of verbally impaired populations; (3) direct comparison of BHW scores to other cognitive style assessment procedures; (4) studying the relationship of BHW scores to intelligence, achievement and personality variables; and (5) evaluating the relationships between individual cognitive style and teaching-learning environments. (Author/KM)

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FINAL REPORT
Project No. 1-E-037
Grant No. OEG-5-71-0029(509)

DEVELOPMENT OF A SCALE TO EVALUATE COGNITIVE STYLES AND ABILITIES

Richard Brozovich, Leon P. Hall
and Richard Watson

Oakland Schools
2100 Pontiac Lake Road
Pontiac, Michigan

August 1972

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SUMMARY

The major objectives of this study were: 1) to provide normative data for the BHW, a non-verbal method of assessing cognitive style, 2) to provide data for item revision and further refinement of the BHW, 3) to assess the effects of grade level (age), sex and socio-economic status on cognitive style.

The BHW was administered to 621 children ranging in grade level from young preschoolers (less than 4½ years old) to third graders. The socioeconomic level and sex of the children at each grade level were balanced.

Grade level proved the most consistent and powerful factor related to cognitive style. Results from the BHW were generally consistent with previous research, indicating for example a decrease in use of color as a grouping category with increased grade level. Both sex and socioeconomic level entered into significant interactions with grade level in their effects related to cognitive style. Neither sex nor socioeconomic level produced consistent effects on cognitive style independent of grade level.

Item analysis was conducted and results indicated a need to revise approximately 25% of the items throughout the scale.

Overall the results were encouraging. The BHW appears capable of assessing aspects of cognitive style among non-verbal populations. It yields results generally consistent with theory and results obtained with other measures of cognitive style. Further plans and recommendations include: 1) revision of the BHW, 2) assessment of verbally impaired populations, 3) direct comparison of BHW scores to other cognitive style assessment procedures, 4) studying the relationship of BHW scores to intelligence, achievement and personality variables, 5) evaluating the relationships between individual congitive style and teaching-learning environments.

INTRODUCTION

Cognitive abilities is an area of child development that has recently come to the forefront for a variety of reasons. General pedagogy has been based on the idea that all children go through a similar process of learning. The theoretical formulations and empirical demonstrations of Jean Piaget (1952) have resulted in re-appraisals of previous beliefs regarding the learning process in children. Piaget's formulations have implications for how the child will respond in a learning situation.

In the United States there has been widespread governmental support of preschool training designed to improve learning abilities. Educators have begun to experiment with new curricula and operational methods in an attempt to discover the most effective means to enhance cognitive development. A key question in the effort to improve training methods is how to fit instructional approaches to the cognitive abilities currently present in pupils in order to achieve meaningful learning outcomes. The research presented in this report is an attempt to answer part of this question through the development of an instrument that will assess some aspects of cognitive abilities in children.

One aspect of cognitive development that has been of research interest is the development of classification behavior among young children. We know that a major accomplishment of human cognition is the process by which our environment is organized into various meaningful classifications. Irving Sigel and his associates (Sigel, I.E.; Anderson, L.M. and Shapiro, H., 1966; Sigel, I.E. and Olmstead, P., 1967) have done studies regarding the development of classificatory behavior. Sigel has shown that individuals develop characteristic "styles of categorization" that are related to social background, sex and personality characteristics.

Sigel's studies have shown that classificatory behavior varies according to the representational level of the object being classified. For example, when children are asked to classify pictures of objects as opposed to actual three dimensional objects, different patterns of classificatory behavior occur. According to Sigel, a higher level of symbolization is required to classify pictures of objects as opposed to actual objects.

Sigel's methodology calls for labelling classificatory behavior into one of the following approaches: 1) Descriptive - which refers to grouping on the basis of an aspect of a set of stimuli, employing objective, physical, manifest cues. The descriptive responses are divided into classification grouping according to color (things belong together because they have the same color), or structural parts (things belong together because they both have wheels, handles, etc.). 2) Relational-Contextual - which refers to groupings made on the basis of the interdependence of items in an array. Objects are

related by virtue of use, for example, "you use a spoon to stir coffee." Also included in this category are objects grouped together on the basis of a thematic interdependence (objects are related on the basis of a story or theme). 3) Inferential-Categorical - which refers to the application of a class label to two objects. This is synonymous with the formulation of a concept; for example, "both animals" or "both tools."

Sigel's research (Sigel, Jarman, and Hanesian, 1967) suggests that style of categorization, or a person's relative preference for the use of the above classificatory approaches, follows an orderly sequence of development and is consistent across various tasks. A person's preferred style of categorization reflects his preferential mode of organizing perceptual stimuli and conceptualizing his external environment. Knowledge regarding this aspect of cognitive functioning has important implications for educational programming and curricula. Research (Sigel, Jarman and Hanesian, 1967; Sigel and Olmstead, 1967) suggests for example, that a dominant Relational-Contextual style indicates an egocentric, impulsive orientation with a reduced capacity to objectify the environment. Reliance on this style may be incompatible with traditional forms of school instruction. Similarly, a failure to develop form as a basis for categorizing may lead to difficulty in development of reading skills.

Ability to use an Inferential-Categorical mode of categorization is the last of the styles of categorization to occur. Use of this style requires a high degree of abstraction and conceptual ability. Sigel's research (Sigel and Olmstead, 1967a, 1967b) indicates that this style is not used with any consistency until the "age of reason" or when children become capable of using symbolic language. This stage occurs at about the first or second grade among Sigel's middle class subjects and later among lower class subjects.

This report describes the development of an instrument and methodology that is capable of assessing some aspects of cognitive style without being dependent upon language skills. This approach has implications for assessing the level of cognitive development and the cognitive style of children who present various types of learning disabilities. This would include categories of children such as the retarded, acoustically handicapped, the disadvantaged and other groups demonstrating learning disabilities.

It is felt that much of the evidence regarding the development of cognitive styles is too dependent on language skills in the children being assessed. In Sigel's work, for example, children's groupings of objects were scored only when they could provide appropriate verbal responses to questions such as "why are these the same or alike."

Furth (1952) has interpreted the theory of cognitive development of Jean Piaget and he stresses that conceptual abilities develop in the absence of verbal language. Furth suggests that children's abilities to conceptualize and reason are typically advanced beyond their ability to express these abilities through the use of language.

Sigel himself has shown an awareness that reliance upon verbal explanation by his subjects placed a restraint upon his ability to measure their cognitive style. He states (Sigel, Anderson and Shapiro, 1966):

> "Failure to respond by not giving a scorable verbal response may not really mean that the children do not comprehend the task. We found, for example, that some children would select the appropriate item, e.g., pick the spoon to be the cup, but when queried as to why, would not be able to verbalize. This happened with sufficient frequency to justify our concluding that for some children an awareness of relationship and a comprehension of that relationship does exist. The inability to verbalize may be a reflection of their limited verbal competence and an inability to objectify these relations. They are perhaps functioning cognitively on what Piaget calls recognitory assimilation, recognizing a relationship to the point of juxtaposing related materials but not being able to explicate the connection into formal language (Piaget, 1952)."

Another example of the effects introduced by the use of language in the measurement methodology is illustrated by the following passage taken from Sigel (Sigel and Olmstead, 1967):

> "Lest we think that color is the most primitive, I hasten to inform you that we discovered among the lower-class kindergarten children that those who did not verbalize rationales for any groupings of items tended to use form as the more frequent basis for grouping. In other words, for those children who were unable to verbalize, form was the more dominant mode, whereas for those children who could verbalize, color was more frequently the preferred criterion. Thus, we propose that form dominance may be in fact the most primitive, followed by color and the reintroduction of form as a criterion when children learn to utilize form labels. The significance of this finding rests on its theoretical contribution to understanding of saliency of particular cues basic to organization of the physical and social environment."

A means to measure cognitive style without relying on language would contribute valuable insights regarding cognitive development in young children. Language fluency would no longer affect scores on the test and cognitive development could be assessed among pre-verbal children as well as children having specific language defects (the deaf, the aphasic, etc.).

There is also the probability that a non-language test would free young children to demonstrate their preferred modes of categorization when they are not under the restraint of having to verbalize a reason for their groupings. It is likely that the necessity to justify their groupings would cause many children to use a readily explained grouping rather than a more complex one that would necessitate a difficult explanation. Requiring verbal explanations of grouping behavior increases precision among scored responses and affords qualitative

insights into children's thinking processes, but simultaneously limits our knowledge about potentials for cognitive functioning that children cannot verbalize. If we are to enhance cognitive development and provide appropriate curricula we must base our instruction on the way children actually respond to the environment in their daily functioning. To assume that the child can think and reason only for levels at which he is able to verbalize would result in underestimating the levels of cognitive functioning present in children.

A pilot version of the current scale was developed in 1970 (Brozovich, R.; Hall, L. and Watson, R., 1970). This scale, called the Brozovich-Hall-Watson (BHW), has shown promise as a non-verbal approach for evoking responses which demonstrate level of cognitive functioning as well as a child's preferred mode of classifying stimuli. Its development was predicated on extensive prior research (Sigel, I.E., Anderson, L.M., and Shapiro, H. 1966; Sigel, I.E., Olmstead, Patricia, 1966-67; Sigel, I.E., 1967) suggesting that children do not use certain categorical modes until a given age (age of development of symbolic language). An underlying rationale for the development of this scale was the assumption that when a verbal explanation is not incorporated into the response pattern and when the items are presented in three dimensional, concrete form, a child will demonstrate capability for cognitive functioning of a higher level and at an earlier age than previously theorized.

Since expressive language is a probable barrier in the measurement of cognitive development, it is also assumed that children with expressive language deficits will demonstrate a higher level of performance in terms of cognitive style on the BHW Scale than on conventional measures of cognitive development.

The BHW Scale is not intended to be an ability test in the traditional sense in that it does not yield a score or quotient which should be equated with an I.Q. or mental age. It is assumed that cognitive functioning is a reflection of "style" or process rather than product and that this may be inferred by a determined pattern of classificatory behavior in a preferential mode of grouping certain stimuli which are presented in a systematic manner. Analysis of such recorded performance should yield a profile or pattern, rather than a score, which should lend itself to statistical inspection for the establishment of normative data related to such criteria as chronological age, sex, clinical diagnostic categories, etc.

The primary objective of the current research was to refine and further develop an evaluation instrument capable of measuring preferred mode of cognitive functioning without dependency upon verbal language. Successful development of such an evaluation instrument would have broad practical and theoretical implications. Following is a list of the most obvious immediate implications:

1) Collection of data regarding cognitive functioning and development in typical children where the restraint of verbal explanation is removed. Previous research (Furth,

1966) indicates that cognitive functioning often proceeds in advance of verbal skills. Findings based on a non-verbal assessment may necessitate theoretical reformulations in the area of cognitive development.

2) Assessment of cognitive functioning among children with verbal language limitations. Such children would include preschoolers, the acoustically handicapped, the mentally retarded and a variety of other children unable to respond adequately to tests requiring verbal responding.

3) Investigation of the personality and behavioral characteristics associated with various cognitive styles when these styles are assessed non-verbally. Further studies could seek to relate cognitive style to various behavioral patterns including emotional disturbance and the various types of learning disability.

4) Investigation to develop teaching strategies best suited to various levels and modes of cognitive functioning. It is possible, for example, that there is too heavy reliance on verbal enrichment in programs such as Head Start. We may be underestimating the cognitive abilities of many children and be failing to provide appropriate experiences to capitalize on already existing abilities.

DESCRIPTION OF THE BHW SCALE

The current BHW Scale consists of sixty items organized into six groups of ten items each. Hence we speak of six interrelated "subtests" of the BHW. Each item consists of a group of three objects attached to hard surfaced 8" x 8" boards which are uniform in composition. The three objects on the 60 boards are grouped to provide for eliciting responses according to the following schema:

A) Color vs. Form, B) Color vs. Relational-Contextual (R-C), C) Color vs. Inferential-Categorical (I-C), D) Form vs. Relational-Contextual, E) Form vs. Inferential-Categorical, and F) Inferential-Categorical vs. Relational-Contextual.

The concepts of Form, Color, R-C and I-C are borrowed from previous work done by Sigel and his associates (Sigel, I.E.; Anderson, L.M., and Shapiro, H., 1966). These classifying criteria were summarized earlier in the report (see pages 1 and 2), with one exception. Form on the BHW refers to a shape classification based on figural or shape similarity between two or three dimensional objects. Sigel and his associates would include what we have designated Form as one type of classification under the more inclusive category of Descriptive-structural parts.

Scores on the BHW provide a measure of preferential grouping style among the categories of Color, Form, R-C and I-C. The following paradigm illustrates the method of presentation.

An otherwise unrelated object of different shape but same color (choice object)	An otherwise unrelated object of different color but same shape (choice object)

Specific object of certain color and shape
(stimulus object)

Ss who choose the unrelated object of the same color are inferred to be organizing objects on the basis of color. Ss selecting the unrelated object of the same shape are inferred to be organizing objects on the basis of shape.

DIRECTIONS FOR ADMINISTERING THE BHW

General testing considerations are followed regarding environment, rapport and procedures with young children. The following instructions were used:

> Since this is intended to be a non-verbal scale, verbal responses and extraneous verbalizations are to be discouraged. The same basic directions apply to the administration of all items. The examiner should be familiar with the standard record form and the method of recording responses. (Subjects responses were recorded directly onto General Purpose NCS Answer Sheets). There are no right or wrong responses. Be sure that the child clearly indicates his choice and record all responses.
>
> Begin with board #1, Group I. Place board below eye level of child. The stimulus item should always be closest to the examiner. Say: "Look at all of these." (Direct attention to all three items in a sweeping manner and then pointing to the two choice items) saying: "Which one of these two goes with this?" (Point to stimulus item.) If the examiner is not certain of the choice indicated, he may ask: "Show me again. Put your finger on it." (Discourage verbal responses when given by saying "You don't have to say the name. Show me.")
>
> Administration may be accomplished in more than one session and discontinuation may be decided at appropriate points when satiation appears to be in evidence; however the entire scale should be administered to each child in the experimental phase. Actual experience indicated that administration time was approximately 15 minutes per child.

METHODS

Seven examiners were trained in the administration of the BHW. Training was easily accomplished. Supervision by the test authors indicated that the trained examiners were administering the test appropriately. No significant difficulties were noted in test administration. Children responded well to the task. Only two subjects

were encountered where the procedure was considered not valid. In one instance we obtained all position responses and in the other case the child was resistant and refused to respond.

Six hundred and twenty one children were administered the revised version of the BHW. The major portion of this sample was composed of Ss controlled for three independent variables: grade level, sex and socio-economic status. Administration took place during March, April and May, 1972.

Socio-economic status was controlled by selecting schools that served homogenous groups of children. Ss were divided into two socio-economic groups: 1) lower middle class (L-M) and 2) upper middle class (U-M). Ss for the L-M group came from three schools that served neighborhoods made up primarily of families where the wage earner was a blue collar worker. Substantial proportions of these families were on some form of welfare or unemployment benefits. Ss for the U-M group came from three schools that served neighborhoods made up primarily of families where the wage earner was a white collar worker or professional person. Most family residences in the L-M schools were in the 12 to 28 thousand dollar range. Most residences in the U-M schools were in the 35+ thousand dollar range.

In addition to the portion of the sample controlled for grade level, sex and socio-economic status, two "unique" groups were evaluated because of their availability in the schools at the time of evaluation. These unique groups included children enrolled in a class for educable retarded and children in a class for perceptual development.

The following chart summarizes the groups evaluated in the major portion of the sample. Results for the two "unique" groups are discussed separately from this sample.

L-M			U-M		
Grade Level	Number		Grade Level	Number	
	M	F		M	F
Young preschool (44-54 mos.)	4	6	Young preschool (44-54 mos.)	32	31
Old preschool (55-65 mos.)	22	24	Old preschool (55-65 mos.)	22	23
Kindergarten	23	27	Kindergarten	27	25
First grade	22	28	First grade	29	26
Second grade	33	26	Second grade	28	24
Third grade	26	26	Third grade	27	22

The sample size for young L-M (N = 10) was too small for meaningful comparison with other groups. This sample size was too small because we were dependent on a "story hour" conducted at several L-M schools to obtain our L-M preschool youngsters. Most of the children attending the "story hour" were above the age requirement for our young preschool sample.

RESULTS

The primary purpose of this research was an investigation of the effects of three factors on BHW scores: grade level, sex and socio-economic level. Data were analyzed by means of three-factor analysis of variance. Results were noted to be statistically significant when they exceeded the .05 level of significance. Data from the young preschool group was not included in the analysis of variance due to the small sample size for the young preschool L-M group.

Color versus Form: Analysis of data from the Color versus Form subtest is shown in Table 1. Color choices were recorded as "correct" to provide data for this analysis.

Table I

Analysis of Variance for Scores
on the Color vs. Form Subtest

Source of Variance	DF	SS	MS	F*
Grade Level	4	14.52	3.63	11.44*
Sex	1	0.03	0.03	0.10
SES	1	2.78	2.78	8.75*
Grade Level x Sex	4	14.92	3.73	11.76*
Grade Level x SES	4	18.10	4.53	14.26*
Sex x SES	1	2.96	2.96	9.32*
Grade Level x Sex x SES	4	1.00	0.25	0.79
Error	490	155.47	0.32	

*$F_{.05}$: 4,490 df = 2.37
$F_{.05}$: 1,490 df = 3.84

Since all 2 x 2 interactions were significant, further analysis was done of simple effects. Table II shows the mean number of Color choices among the various sub-groups used in analyzing for simple effects. Ten minus the number shown is the mean number of Form responses for each group.

Analysis of simple effects was accomplished by means of a simple randomized design (for the various grade levels at any level of sex or SES), by means of t-tests in comparing males versus females or U-M class versus L-M class at a specific grade level, and by means of t-tests in comparing sexes at one level of SES or comparing SES levels for a particular sex for subjects combined over grade level.

Table II[1]

Mean Number of Color Choices for
Various Sub-groups on the Color vs. Form Subtest

SES Levels Combined

	Preschool	Kg	1st	2nd	3rd
Male*	4.00	3.35	2.53	2.56	2.43
Female*	4.51	3.70	2.25	2.52	2.47

Sexes Combined

U-M Class*	4.00	3.87	2.05	2.48	1.73
L-M Class*	4.59	3.24@	2.75@	2.74	3.19@

Grade Levels Combined

	Male	Female+
U-M Class	2.83	2.71
L-M Class	3.03	3.40

[1]The numbers of subjects in the various groups above can be determined by reference to the chart on page 7. Significant differences are indicated as follows:

1) An asterisk (*) following the words Male, Female, U-M Class or L-M Class indicates that the one way analysis of variance (simple randomized design) yielded a significant F across the grade levels for the group specified. Comparisons of means between pairs of grade levels were not performed when the trend of scores across grade level was evident. In cases where means between pairs of grade levels were compared, these data are discussed in the body of the report.

2) An @ between two means at a specific grade level indicates a significant difference between the means at that grade level for the Male - Female or U-M - L-M data being displayed.

3) In the "grade levels combined" section of the table, significant differences between Male versus Female and U-M versus L-M comparisons across all grade levels are indicated as follows: a + sign by Male indicates a significant difference between U-M and L-M males, a + sign by Female indicates a significant difference between U-M and L-M females, a + sign by U-M Class indicates a significant difference between U-M males and females and a + sign by L-M Class indicates a significant difference between L-M males and females.

Analysis of the simple effects showed that grade level was a statistically significant factor relating to subtest scores at each level of both Sex and SES. Inspection of the relevant section of Table II shows that there is a generalized progressive decline in the proportion of Color choices among all groups as grade level increases. One dramatic exception to the general decline in Color selection at higher grade levels occurred among third grade L-M subjects. This group showed a relatively higher frequency of Color selection that contradicted the general trend of results on this subtest.

No statistically significant differences were found between sexes at the various grade levels.

There were statistically significant differences between U-M and L-M subjects at the grade levels of kindergarten, first grade and third grade. At kindergarten, the U-M subjects selected more Color responses than L-M subjects, while at both first and third grade the L-M subjects selected more Color responses. Inspection of the relevant data in Table II shows that the L-M subjects, after a large decrease in frequency of Color selection from preschool to kindergarten, show little further decrease in Color selection through the third grade. U-M subjects show their greatest decrease in Color selection between kindergarten and first grade and show a further large decline in Color selection at the third grade.

For data combined across all grade levels, there was one significant difference, with L-M females showing a greater frequency of Color selection than U-M females.

Color versus R-C: Table III shows the overall analysis of results from the Color versus R-C subtest. Color choices were recorded as "correct" to provide data for this analysis.

Table III

Analysis of Variance for Scores
on the Color vs. R-C Subtest

Source of Variance	DF	SS	MS	F*
Grade Level	4	21.51	5.38	22.30*
Sex	1	0.07	0.07	0.28
SES	1	0.01	0.01	0.06
Grade Level x Sex	4	22.26	5.57	23.08*
Grade Level x SES	4	21.63	5.40	22.43*
Sex x SES	1	0.25	0.25	1.03
Grade Level x Sex x SES	4	2.00	0.50	2.07
Error	490	118.14	0.24	

*$F_{.05}$: 4,490 df = 2.37
$F_{.05}$: 1,490 df = 3.84

Since the Grade Level x Sex and Grade Level X SES interactions were significant, simple effects involving these factors were analyzed. Table IV shows the mean number of Color choices among the various sub-groups used in analyzing for simple effects. Ten minus the number shown is the mean number of R-C responses for each group.

Table IV[1]

Mean Number of Color Choices for
Various Sub-groups on the Color vs. R-C Subtest

SES Levels Combined

	Preschool	Kg	1st	2nd	3rd
Male*	4.70	4.64	3.30	3.19	2.39
Female*	5.16	4.37	2.84	3.05	2.59

Sexes Combined

U-M Class*	4.98	5.12	3.09	3.23	2.35
L-M Class*	5.02	3.98@	3.13	3.17	2.71

[1]See footnote to Table II

Grade level was a statistically significant factor relating to subtest scores at each level of both Sex and SES. The data in Table IV shows a generalized progressive decline in the proportion of Color choices among all groups as grade level increases. There are several exceptions to this general trend, (ex: an increase from first to second grade among females) but the powerful effect of grade level is clearly evident in the data.

No statistically significant differences were found between sexes at the various grade levels. There were differences at kindergarten (more Color responses by females) and first grade (more Color responses by males) that were very close to being statistically significant.

There was a statistically significant difference between U-M and L-M subjects in kindergarten, with the U-M subjects selecting more Color responses.

For data combined across all grade levels, there were no statistically significant differences attributable to Sex or SES.

Color versus I-C: Table V shows the overall analysis of results from the Color versus I-C subtest. Color choices were recorded as "correct" to provide data for this analysis.

Table V

Analysis of Variance for Scores on the Color vs. I-C Subtest

Source of Variance	DF	SS	MS	F*
Grade Level	4	34.82	8.70	35.95*
Sex	1	0.30	0.30	1.25
SES	1	1.33	1.33	5.50*
Grade Level x Sex	4	35.97	8.99	37.14*
Grade Level x SES	4	36.90	9.23	38.10*
Sex x SES	1	1.71	1.71	7.05*
Grade Level x Sex x SES	4	1.00	0.25	1.03
Error	490	118.65	0.24	

*$F_{.05}$: 4,490 df = 2.37
$F_{.05}$: 1,490 df = 3.84

Since all 2 x 2 interactions were significant, further analysis was done of simple effects. Table VI shows the mean number of Color responses among the various sub-groups used in analyzing for simple effects. Ten minus the number shown is the mean number of I-C responses for each group.

Table VI

Mean Number of Color Choices for Various Sub-groups on the Color vs. I-C Subtest

SES Levels Combined

	Preschool	Kg	1st	2nd	3rd
Male*	4.25	3.03	2.15	1.20	1.09
Female*	4.71	3.55@	1.69	1.55	1.42

Sexes Combined

U-M Class*	4.07	3.44	1.95	1.38	.86
L-M Class*	4.98@	3.20	1.84	1.51	1.67@

Grade Levels Combined

	Male	Female
U-M Class	2.17	2.36
L-M Class	2.30	2.74

Grade level was a statistically significant factor relating to subtest scores at each level of both Sex and SES. With the exception of one relatively small reversal (a small increase from second to third grade among L-M subjects) there was a strong trend for Color responses to decrease as grade level increased.

One statistically significant difference was found between sexes at various grade levels. This occurred among kindergarteners, where females selected the Color choice more often than males.

There were statistically significant differences between U-M and L-M subjects at both preschool and the third grade, with L-M subjects selecting more Color choices in both instances.

For data combined across all grade levels, there were no statistically significant differences attributable to Sex or SES. The L-M females had the highest number of Color responses and comparisons of this group with both the U-M females and L-M males were close to being statistically significant.

Form versus R-C: Table VII shows the overall analysis of results from the Form versus R-C subtest. Form choices were recorded as "correct" to provide data for this analysis.

Table VII

Analysis of Variance for Scores on the Form vs. R-C Subtest

Source of Variance	DF	SS	MS	F*
Grade Level	4	4.31	1.08	6.03*
Sex	1	0.04	0.04	0.21
SES	1	0.17	0.17	0.93
Grade Level x Sex	4	4.97	1.24	6.95*
Grade Level x SES	4	5.57	1.39	7.78*
Sex x SES	1	0.81	0.81	4.53*
Grade Level x Sex x SES	4	0.00	0.00	0.00
Error	490	87.67	0.18	

*$F_{.05}$: 4,490 df = 2.37
$F_{.05}$: 1,490 df = 3.84

Since all 2 x 2 interactions were significant, further analysis was done of simple effects. Table VIII shows the mean number of Form responses among the various sub-groups used in analyzing for simple effects. Ten minus the number shown is the mean number of R-C responses for each group.

Table VIII

Mean Number of Form Choices for
Various Sub-groups on the Form vs. R-C Subtest

SES Levels Combined

	Preschool	Kg	1st	2nd	3rd
Male*	6.50	6.18	5.34	5.70	4.91
Female*	5.89@	6.02	5.52	5.34@	5.37@

Sexes Combined

U-M Class*	6.58	6.63	5.15	5.65	5.35
L-M Class*	5.91@	5.64@	5.80@	5.51	5.06

Grade Levels Combined

	Male+	Female
U-M Class	5.96	5.62
L-M Class	5.41	5.64

Grade level was a statistically significant factor relating to subtest scores at each level of both Sex and SES. There was a generalized decline in the proportion of Form responses among all groups as grade level increased. This decline in Form responses was not as pronounced as the drop in Color responses on the Color versus R-C subtest as grade level increased.

There are some minor exceptions to the decrease in Form responses with increased grade level. With U-M subjects, for example, there is a large decrease in Form responses from preschool to first grade, but then the proportion of Form responses rises slightly in second and third grade. Inspection of the data in Table VIII shows that most of the decrease in Form responses occurs between preschool and first grade among all groups. For all groups combined, Form accounted for approximately 62% of the responses in the Form versus R-C subtest at the preschool and kindergarten level and drops to about 54% of the responses in first through third grade.

Statistically significant differences were present between sexes at three grade levels; preschool, second grade and third grade. For preschool and second grade, males gave more Form responses than females. At third grade, females gave more Form responses than males.

Statistically significant differences were present between U-M and L-M subjects at three grade levels; preschool, kindergarten and first grade. At preschool and kindergarten the U-M subjects used

Form responses more often than L-M subjects. At first grade the L-M subjects used Form more frequently.

For data combined over all grade levels, there was one statistically significant difference. U-M males used Form with greater frequency than L-M males.

Form versus I-C: Table IX shows the overall analysis of results from the Form versus I-C subtest. Form choices were recorded as "correct" to provide data for this analysis.

Table IX

Analysis of Variance for Scores on the Form vs. I-C Subtest

Source of Variance	DF	SS	MS	F*
Grade Level	4	19.43	4.86	21.90
Sex	1	0.33	0.33	1.50
SES	1	0.36	0.36	1.62
Grade Level x Sex	4	20.35	5.09	22.94*
Grade Level x SES	4	20.25	5.06	22.83*
Sex x SES	1	0.87	0.87	3.91*
Grade Level x Sex x SES	4	0.00	0.00	0.00
Error	490	108.66	0.22	

*$F_{.05}$: 4,490 df = 2.37

$F_{.05}$: 1,490 df = 3.84

Since all 2 x 2 interactions were significant, further analysis was done of simple effects. Table X shows the mean number of Form responses among the various sub-groups used in analyzing for simple effects. Ten minus the number shown is the mean number of I-C responses for each group.

Table X

Mean Number of Color Choices for Various Sub-groups on the Form vs. I-C Subtest

SES Levels Combined

	Preschool	Kg	1st	2nd	3rd
Male*	5.90	5.70	4.42	4.05	3.20
Female*	5.35@	5.04@	4.31	3.33@	3.47

Table X continued

Sexes Combined

	Preschool	Kg	1st	2nd	3rd
U-M Class*	5.44	5.60	4.13	3.90	3.27
L-M Class*	5.87	5.26	4.57@	3.66	3.48

Grade Levels Combined

	Male	Female
U-M Class	4.58	4.21
L-M Class	4.58	4.38

Grade level was a statistically significant factor relating to subtest scores at each level of both Sex and SES. Form responses showed a gradual decline as grade level increased, dropping in a steady progression (for all groups combined) from 56% of the responses in preschool to 34% of the responses in third grade.

Statistically significant differences were present between sexes at the grade levels of preschool, kindergarten and second grade. At each of these grade levels, males produced more Form responses than females.

There was one statistically significant difference between U-M and L-M subjects. At the first grade, L-M subjects used Form more frequently than U-M subjects.

There were no statistically significant differences related to Sex or SES for data combined over all grade levels. For U-M subjects, the difference between males and females was close to statistical significance, with males giving more Form responses.

I-C versus R-C: Table XI shows the overall analysis of results from the I-C versus R-C subtest. I-C responses were recorded as "correct" to provide data for this analysis.

Table XI

Analysis of Variance for Scores
on the I-C vs. R-C Subtest

Source of Variance	DF	SS	MS	F
Grade Level	4	4.64	1.16	9.71*
Sex	1	0.06	0.06	0.52
SES	1	2.36	2.36	19.77*
Grade Level x Sex	4	5.22	1.30	10.92*
Grade Level x SES	4	8.57	2.14	17.93*
Sex x SES	1	2.43	2.43	20.33*
Grade Level x Sex x SES	4	0.00	0.00	0.00
Error	490	58.53	0.12	

*$F_{.05}$: 4,490 df = 2.37
$F_{.05}$: 1,490 df = 3.84

Since all 2 x 2 interactions were significant, further analysis was done of simple effects. Table XII shows the mean number of I-C responses among the various sub-groups used in analyzing for simple effects. Ten minus the number shown is the mean number of R-C responses for each group.

Table XII

Mean Number of I-C Choices for
Various Sub-groups on the I-C vs. R-C Subtest

SES Levels Combined

	Preschool	Kg	1st	2nd	3rd
Male*	6.30	6.39	6.40	7.72	7.50
Female*	6.49	6.61	6.69@	7.34@	7.30

Sexes Combined

U-M Class*	6.62	7.25	7.05	7.50	8.00
L-M Class*	6.28@	5.88@	6.25@	7.79@	6.94@

Grade Levels Combined

	Male+	Female+
U-M Class	7.18	7.30
L-M Class	6.64	6.49

Grade level was a statistically significant factor relating to subtest scores at each level of both Sex and SES. Data displayed in Table XII shows that the major trend was for I-C choices to increase as grade level went up. Most of the increase in the proportion of I-C responses occurred between first and second grade. I-C responses averaged about 66% of the choices at preschool, kindergarten and first grade and jumped to about 75% of the choices in second and third grade (these figures are for data combined over Sex and SES).

Statistically significant differences occurred between sexes at first and second grade. Among first graders, females gave significantly more I-C responses, while among second graders males gave significantly more I-C responses.

Statistically significant differences occurred between U-M and L-M subjects at all five grade levels. At preschool, kindergarten, first grade and third grade levels the U-M subjects gave more I-C responses. At second grade there was an unusual reversal, with L-M subjects using I-C more often. The higher proportion of I-C among L-M subjects at the second grade is a contradictory finding and suggests that some strong, extraneous factor was operating to influence the choices of the second graders. Since the L-M second graders came primarily from one classroom, and all from one school, it is plausible that a teacher or school variable was operating to influence scores. It is feasible, for example, that a particular teacher's approach to teaching might emphasize a certain cognitive approach and thereby influence the cognitive styles of students.

For data combined across all grade levels, there were significant differences between U-M and L-M subjects across both sexes. Among both males and females the U-M subjects gave more I-C responses.

Since the most powerful factor affecting BHW scores was grade level, the basic data for Ss at various grade levels (combined across socio-economic level and sex) is presented in detail. Table XIII summarizes the data for Ss at all grade levels. Each sub-part of the BHW is represented by ten items, so percentage frequencies for each sub-part in Table XIII are based on the following number of total responses for each grade level: Young Preschool (44-54 months old) 730; Old Preschool (55-65 months old) 910; Kindergarten 1,020; First Grade 1,110; Second Grade 1,050; and Third Grade 1,010. Note that this table includes data from young preschool children that was not included among the data used for statistical analysis by analysis of variance.

Table XIII

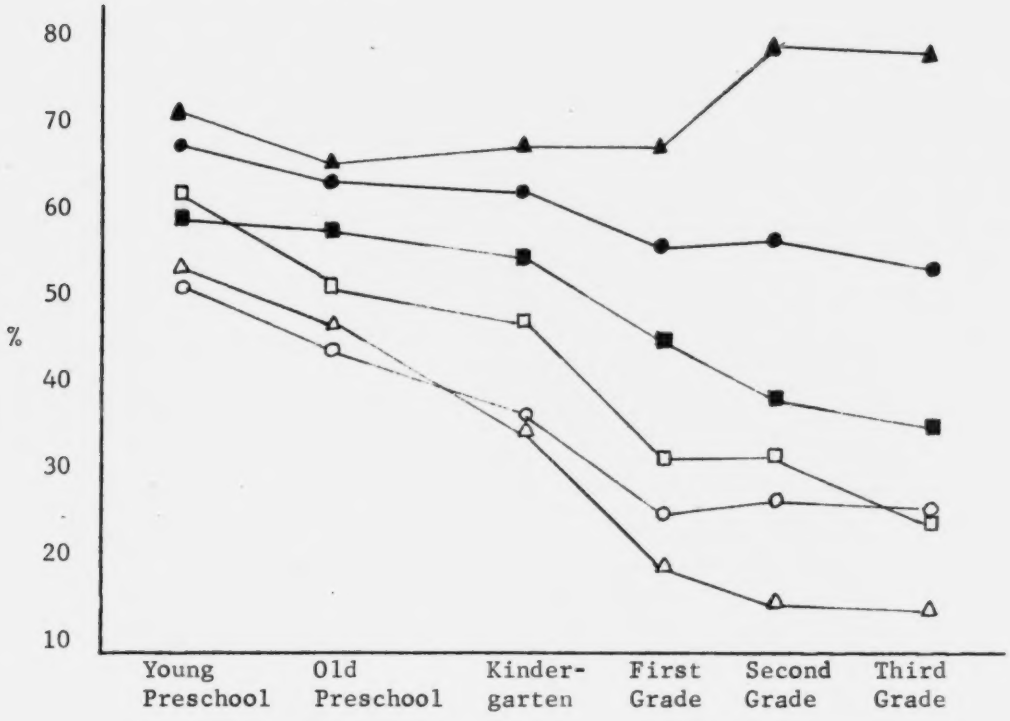
Response Percentages on Sub-parts of the BHW as a Function of Grade Level

	Young Preschool (N=73)	Old Preschool (N=91)	Kinder-garten (N=102)	First Grade (N=111)	Second Grade (N=105)	Third Grade (N=101)	Total (N=583)
Color vs. Form (% Color Recorded)	50	43	36	24	26	25	33
Color vs. R-C (% Color Recorded)	61	50	46	31	32	25	39
Color vs. I-C (% Color Recorded)	52	45	33	19	14	13	28
Form vs. R-C (% Form Recorded)	66	62	61	55	56	52	58
Form vs. I-C (% Form Recorded)	58	57	54	44	38	34	47
I-C vs. R-C (% I-C Recorded)	70	64	66	66	76	75	70

Figure 1 depicts the data from Table XIII in graphic form.

Figure 1*

Response Percentages on Sub-parts of the
BHW as a Function of Grade Level



*Key:

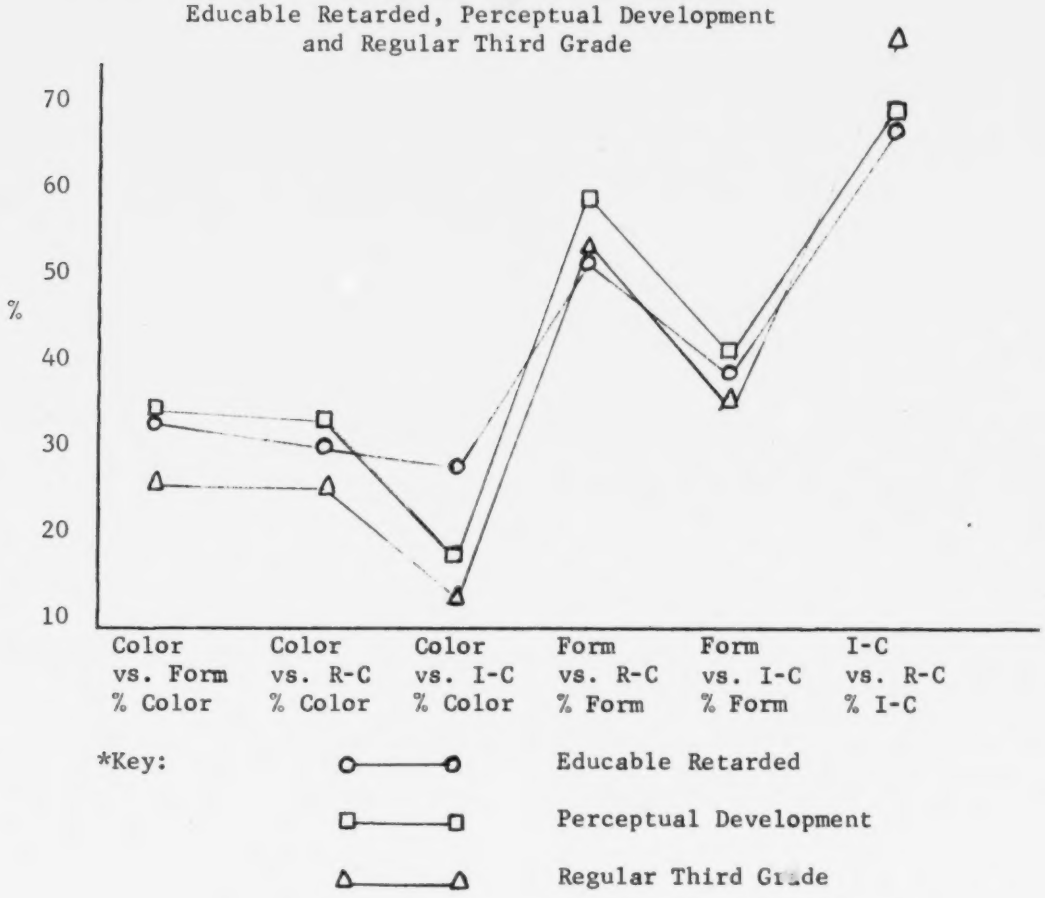
- Color vs. Form, % Color recorded
- Color vs. R-C, % Color recorded
- Color vs. I-C, % Color recorded
- Form vs. R-C, % Form recorded
- Form vs. I-C, % Form recorded
- I-C vs. R-C, % I-C recorded

In addition to the major sample, scores were obtained for 23 children in a class for the educable mentally retarded and for 15 children in a class for children with perceptual-motor deficits (perceptual development class). The children in the classes for educable retarded had an average age of 10 years 3 months, while the children in classes for perceptual development had an average age of 8 years 9 months.

Several trends are indicated by the data obtained from the children in these special education classes. For purpose of discussion, Figure 2 shows the percentages of responses among the six subtests for these groups (both sexes combined). The results for regular third grade students (combined across Sex and SES) are also presented in Figure 2 to provide a basis of comparison. It should be noted that on an average, the children from classes for the educable retarded were older than the regular third graders, while the perceptual development classroom children were approximately the same age as the regular third graders.

Figure 2*

Response Percentages on Sub-parts of the BHW for Children from Three Classrooms: Educable Retarded, Perceptual Development and Regular Third Grade



Notable in Figure 2 is the finding that both special education groups tend to give responses characteristic of younger children. Previous results have indicated, for example, that Color, when paired with any other alternative, tends to decrease with grade (age) level. Figure 2 shows that both special education groups responded with greater Color preference than third graders on all three subtests involving Color. Results on the three subtests not involving Color are not as definitive, but again there is a tendency for the preferences of the special education groups to be characteristic of younger children (slightly more Form than third graders on Form vs. I-C). These findings are tentative due to the small numbers involved, but suggest that the cognitive style of children in these types of special education classes differs significantly from the cognitive style of randomly selected children of comparable ages.

Since the purpose of the current research was to establish tentative norms and provide data for item revision, attention was devoted to group differences rather than individual differences in cognitive style. Inspection of the data suggests, however, that individual differences may be of greater significance than group trends. After further revision of the scale, it is anticipated that intensive investigations of individual differences in cognitive style will be done. As an example of the type of individual differences that are found in the data, profiles for three extreme protocols are displayed in Table XIV.

Table XIV

Profile Patterns on the BHW for
Three First Grade, Upper Middle Class Subjects

	Color vs. Form % Color	Color vs. R-C % Color	Color vs. I-C % Color	Form vs. R-C % Form	Form vs. I-C % Form	I-C vs. R-C % I-C
Subject 1	0	10	10	60	40	90
Subject 2	100	100	100	50	60	90
Subject 3	10	40	10	30	20	30

The data in Table XIV indicates that these three subjects (from the same classroom) are functioning with widely disparate cognitive styles. Subject 1 ignores Color as a basis for grouping, uses Form to moderate degree and relies heavily on R-C and I-C as a basis for grouping. Subject 2 responds consistently to Color as a basis for grouping and uses R-C infrequently. Subject 3 uses Color infrequently as a basis for grouping and also uses Form infrequently (except when the choice is Color vs. Form, in which case the subject used Form over Color). Subject 3 was one of few subjects who consistently chose R-C over I-C in the I-C vs. R-C subtest.

At this stage in development of the BHW we know that there are large individual differences in subtest patterns, but we can only hypothesize possible implications of these findings. Further research will be necessary to establish whether these individual differences are stable and to determine if such differences have practical implications for learning processes and teaching methods.

All sixty items of the BHW were plotted on individual graphs for the purpose of item analysis. The data obtained for each item will be used for future revisions in an attempt to make the total scale more consistent, improve subtest reliability and increase validity of the subtests. Two basic criteria were used in evaluating items:

1) does the item show grade level changes in preferred selection frequencies that are consistent with results for the total subtests?

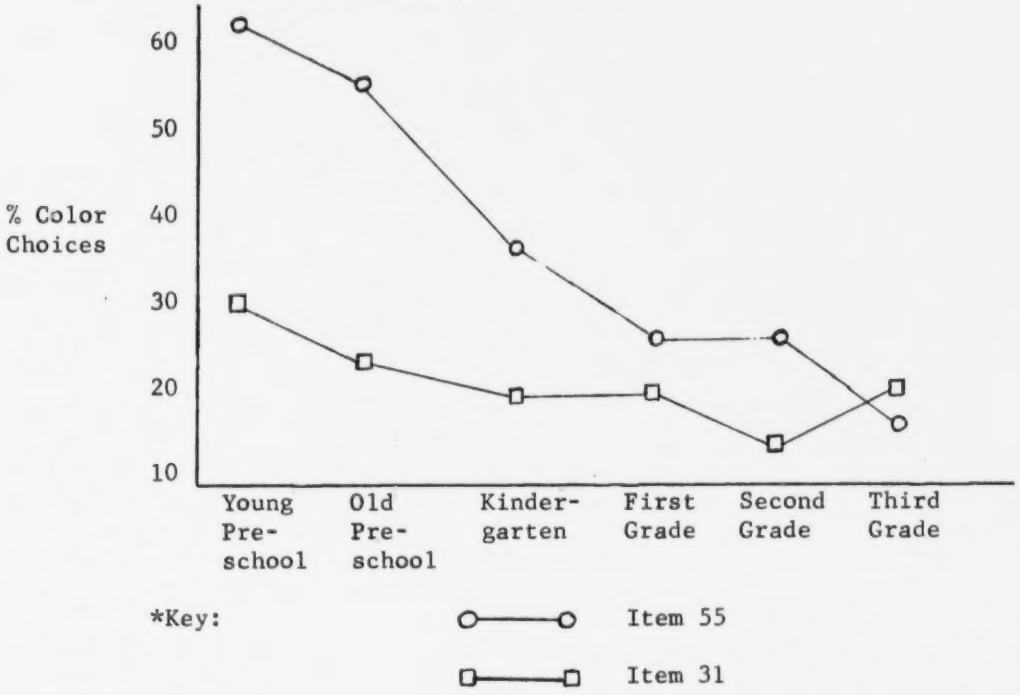
2) does the item produce selection frequencies close to 50% among the two alternatives presented?

Examples of items that will be retained or rejected are presented to offer the reader an example of the procedure being employed. Space limitations preclude a discussion of this procedure for all 60 items in the scale.

Color versus Form: To be retained in this subtest an item must show characteristics similar to that of the total subtest. Since the Color versus Form subtest showed a significant drop in Color selection frequency as grade level increased, individual items must reflect this characteristic to be retained. Preliminary analysis suggests that seven of the ten items in this subtest will be retained in a future revision. Figure 3 shows the characteristics of an item to be retained (item 55) and an item to be rejected (item 31).

Figure 3*

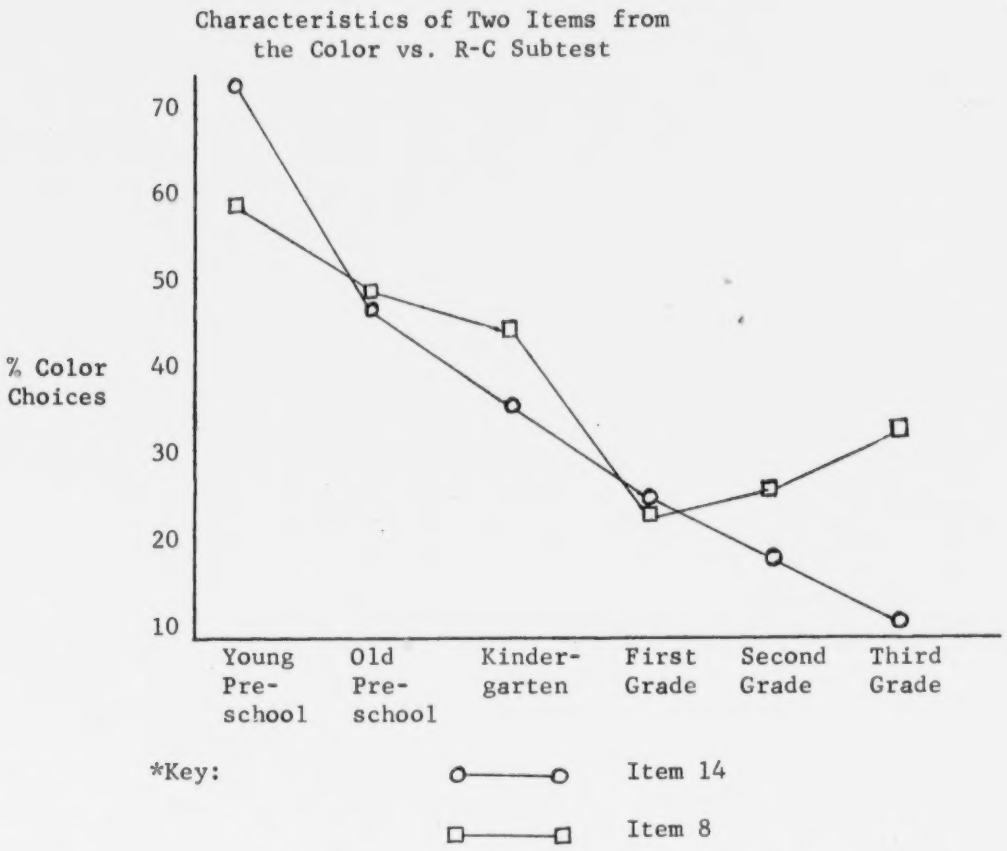
Characteristics of Two Items from the Color vs. Form Subtest



Note that item 55 shows a steep progressive drop in frequency of Color selection as grade level increases. Item 31 maintains a frequency of close to 20% Color selection across all grade levels.

Color versus Relational-Contextual: Since the Color versus R-C subtest showed a significant drop in Color selection frequency as grade level increased, individual items must reflect this characteristic to be retained. Preliminary analysis suggests that six of the ten items in this subtest will be retained. Figure 4 shows the characteristics of an item to be retained (item 14) and an item to be rejected (item 8).

Figure 4*



Inspection of Figure 4 shows that item 14 shows a steep progressive drop in frequency of Color selection as grade level increases. Item 8 shows an initial drop in frequency of Color selection, but a subsequent rise among second and third graders.

Color versus Inferential-Categorical: Items on this subtest must show a significant drop in Color selection frequency as grade level increases if they are to be retained. Preliminary analysis suggests that eight of the ten items in this subtest will be retained. Figure 5 shows the characteristics of an item to be retained (item 15) and an item to be rejected (item 51).

Figure 5*

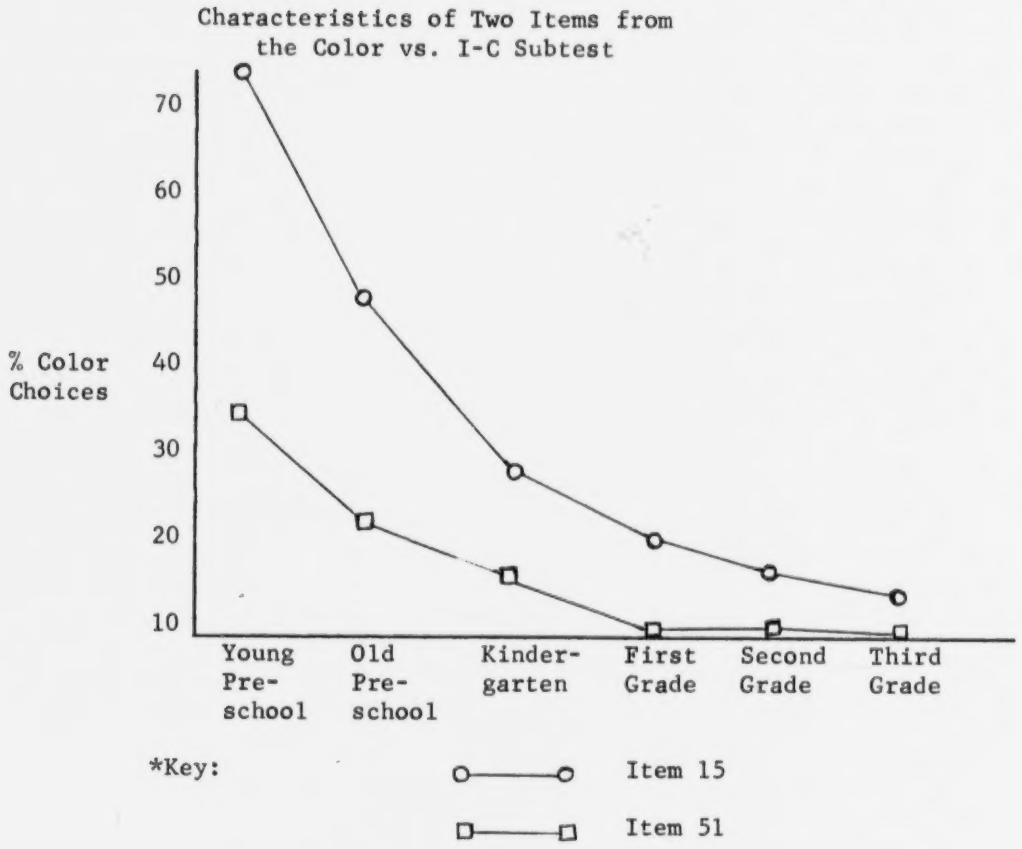


Figure 5 shows a steep progressive drop in frequency of Color selection for item 15 as grade level increases. Item 51 shows only a moderate drop in frequency of Color selection as grade level increases and there is a slight rise in frequency of Color selection among second graders. Another reason for possible replacement of item 51 is the low frequency of Color selections even among preschool Ss. This finding suggests an imbalance in attractiveness of the choice items that is resulting in a high probability of I-C selection among young Ss where Color is ordinarily the dominant selection.

Form versus Relational-Contextual: On this subtest there was a small gradual shift toward increased selection of R-C as grade level increased. The criterion for retention or a rejection of items in this subtest was a drop in Form as grade level increased and frequencies close to 50% among the two alternatives presented. Preliminary analysis indicated that only five of the ten items in this subtest will be retained. Figure 6 shows the characteristics of an item to be retained (item 34) and an item to be rejected (item 10).

Figure 6*

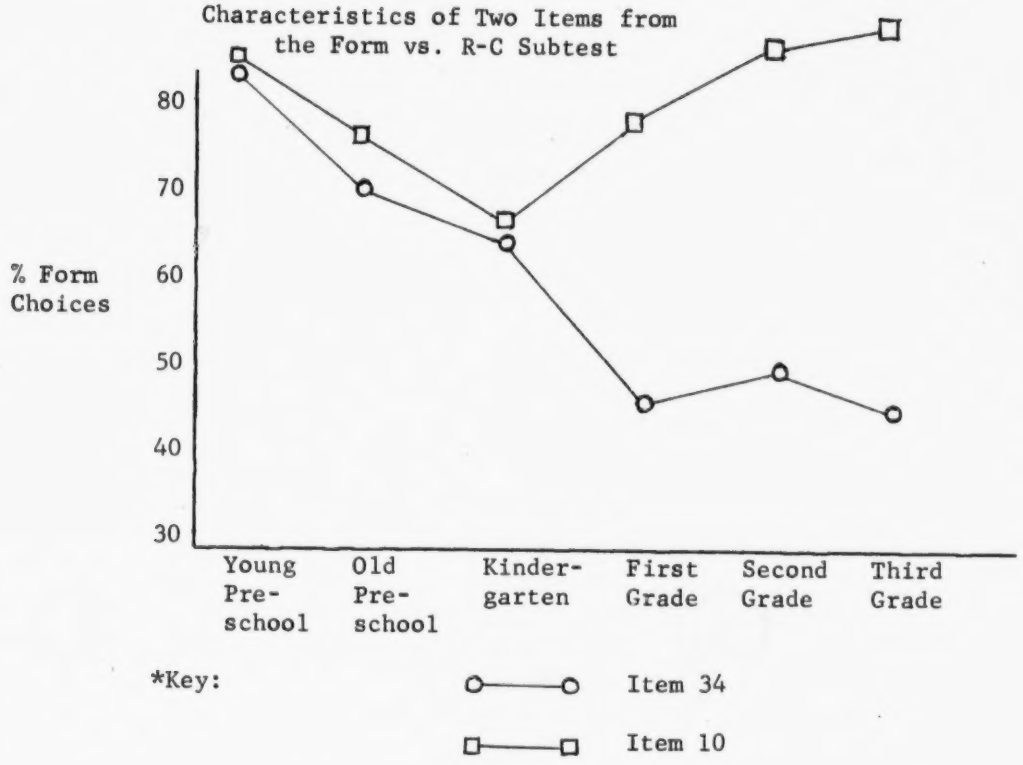
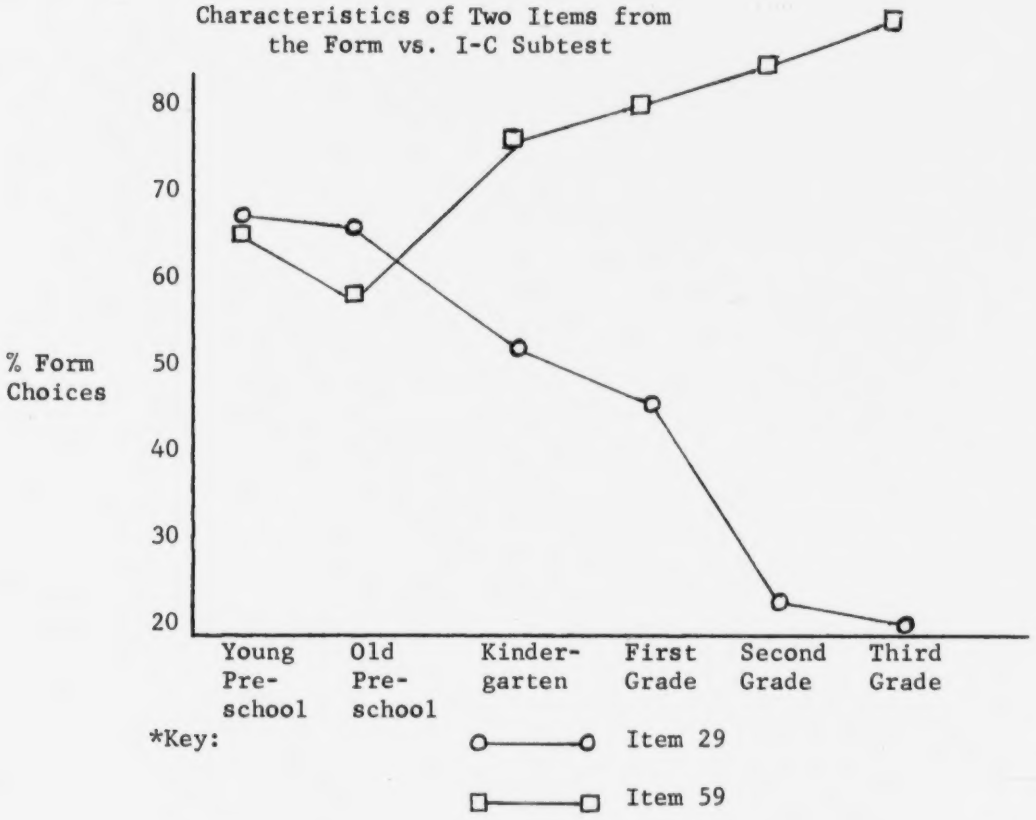


Figure 6 shows that item 34 produced a steady decrease in Form responses as grade level increased. Item 10 has high percentages of Form across all grade levels, an indication that the item probably does not contribute sufficient variance to warrant its inclusion in a test revision.

Form versus Inferential-Categorical: This subtest showed a significant drop in Form selection frequency as grade level increased. Preliminary analysis indicates that seven of the ten items on the subtest will be retained. Figure 7 shows the characteristics of an item to be retained (item 29) and an item to be rejected (item 59).

Figure 7*



As shown in Figure 7, the percentages of Form responses drops sharply in item 29 as grade level increases. Item 59 shows a trend opposite from that of total subtest scores, with the percentage of Form responses increasing as grade level increases. This was the only item in the whole test to yield results strongly opposed to the major trend of the subtest in which the item was included. It is evident that this item is conceptually wrong since it yields results inconsistent with expectations. Replacement of this item with an appropriate item should yield a markedly better relationship between Form versus I-C subtest scores and grade level in a future revision of the scale.

Inferential-Categorical versus Relational-Contextual: This subtest showed no clear pattern in shift of preferred category as grade level increased. There was a small, gradual trend toward increased I-C as grade level increased, but this trend was not significant. Retention of items for this subtest will be judged on the basis of the degree to which items yield selection frequencies close to 50% among the two alternatives presented. Analysis indicates that the I-C category was strongly preferred over R-C in six of the ten items of this subtest. All six of these items will be revised in an attempt to achieve better balance between I-C and R-C responses.

CONCLUSIONS AND RECOMMENDATIONS

Previous results with the pilot version of the BHW (Brozovich, Hall and Watson, 1970) and results of the current investigation support the following tentative conclusions regarding cognitive style and the BHW as a method of assessment:

1) Children at preschool ages are capable of groupings involving Color, Form, R-C and I-C at well above chance levels (Brozovich, Hall and Watson, 1970).

2) Children respond well to the non-verbal test format of the BHW.

3) There are consistent grade (age) level changes in the relative frequencies of children's grouping preferences. Younger children select Color more frequently than older children when Color is opposed to any of the other three grouping criteria. In groupings involving Form versus either R-C or I-C, younger children select the Form choice more frequently than older children. No consistent pattern has emerged to relate grade (age) level and preferences on the R-C versus I-C subtest.

4) The factors of Sex and SES do not relate to cognitive style in a consistent manner across grade levels. Significant interactions occurred between grade level and both Sex and SES. These findings suggest fruitful avenues to pursue in further research. Among the more intriguing of such results, were findings on the three subtests involving Color (Color vs. Form, Color vs. R-C and Color vs. I-C). At the preschool level, females chose Color more often than males on all three of these subtests (although none of these differences were statistically significant, all three were close to statistical significance). At grade level 1, the trend was reversed and males chose Color more often than females on all three of these subtestss (two of these differences were close to statistical significance). These results suggest a possible age-sex interaction in the development of cognitive style that should be investigated more intensively in a future study.

The three subtests involving Color also were prominent among the interactions between grade level and SES. At the preschool level, L-M children chose Color more often on all three subtests (one difference was statistically significant and one was close to statistical significance). In kindergarten, the pattern reversed, with U-M children choosing Color more often on all three subtests (two of the differences were statistically singificant). By third grade the pattern is reversed again, and L-M children chose Color more often on all three subtests (two of the differences were statistically significant). This puzzling pattern suggests a need for caution in interpreting SES differences where data involves only one age group of children.

There was one subtest on which SES had a relatively consistent effect across grade level and sex. This occurred on the I-C versus R-C subtest, where U-M subjects selected more I-C responses than L-M subjects. This difference was significant among both males and females across all grade levels combined.

Many promising areas for future research are suggested by the results of the current study. Recommendations for further research include the following:

1) Revision of the current scale based on item analysis as described in this report.

2) Study of the relationships between cognitive styles of students and other characteristics such as intelligence, academic achievement and personality characteristics.

3) Study of the influence of various teaching-learning environments on the development of cognitive style.

4) Longitudinal studies to determine the stability of measures of cognitive style.

5) Investigation of the effectiveness of various teaching methods for students with different cognitive styles.

6) Further study of the relationship of basic characteristics such as age, SES and sex to cognitive style.

7) Investigation of the relationships among various methods of assessing cognitive style.

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